

DOCUMENT RESUME

ED 167 183

ID 087 099

AUTHOR Versteegh-Linberg, Joyce E. A.
TITLE Computers and Curricula in the New Jersey Secondary Public Schools.
PUB DATE 22 Dec 78
NOTE 59p.; M.ed. Trenton State College
EDRS PRICE MF-\$0.83 HC-\$3.50 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Science Education; Education Majors; Higher Education; *Mathematics Education; Programing Languages; Questionnaires; *School Surveys; *Secondary Education; Secondary Schools; State Surveys; Teacher Education

ABSTRACT

This 1978 survey of 408 New Jersey secondary public schools found that 242 of them use a computer for instructional purposes. Primarily the computer is used in teaching students to write programs and as a computational aid to problem solving, with mathematics departments making the greatest use of these applications. The survey results justify the practice of those colleges already offering computer science courses for undergraduate and graduate mathematics education majors. It is recommended that mathematics education curricula and inservice programs be modified to include other computer related courses in addition to computer science courses. A bibliography and copies of the questionnaires used together with cover letters and instructions are included.
(Author/JEG)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED167183

TRENTON STATE COLLEGE

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

Trenton, New Jersey 08625

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

COMPUTERS AND CURRICULA IN THE
NEW JERSEY SECONDARY PUBLIC SCHOOLS

A Thesis submitted in Partial
Fulfillment of the Requirements for the Degree
of Master of Education in Mathematics

by

Joyce E.A. Versteegh-Limberg

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Joyce E.A. Versteegh-

Limberg

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC) AND
USERS OF THE ERIC SYSTEM."

Approved by the Thesis Committee:

David E. Boliver

Date Dec. 13, 1978

Norman E. Cromack

Date Dec. 13, 1978

Charles H. Goldberg

Date Dec. 13, 1978

Henrietta Hubbard

Date Dec. 13, 1978

James R. Hall

Date Dec. 22, 1978

Graduate Dean

IR007099

ABSTRACT

This 1978 survey of the 408 New Jersey secondary public schools found that 242 of them use a computer for instructional purposes. In most schools, the computer is used in teaching students to write programs and as a computational aid to problem solving, with the mathematics department making the greatest use of these computer applications. The survey results justify the practice of those colleges already offering computer science courses for undergraduate and graduate mathematics education majors. It is recommended that mathematics education curricula and in-service programs be modified to include other computer-related courses in addition to computer science courses.

ACKNOWLEDGMENTS

Sincere appreciation and especial thanks go to Dr. David E. Boliver, the chairperson of the writer's thesis committee for his time, assistance, patience, and good humor during the course of preparing this thesis. Thanks are also extended to the other members of the thesis committee: Dr. Norman Cromack, Dr. Charles Goldberg, and Mrs. Henrietta Hubbard. Their interest in this study and their advice are much appreciated. The writer is appreciative, too, of the contributions of others, among them Mr. Charles M. Wine and Mr. Robert S. Duncan, who supplied helpful hints and lent related literary material, and, of her husband Allen LeRoy Limberg, who supported her in her efforts.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	iv
 Chapter	
I INTRODUCTION	1
Statement of The Problem	1
Statement of The Purpose of The Study	1
Review of The Selected Related Literature	1
II PROCEDURES OF THE STUDY	8
III RESULTS OF THE STUDY	9
Presentation of Data	9
Interpretation of Data	26
IV DISCUSSION	29
Recommendations	29
Implications for Further Study	30
SELECTED BIBLIOGRAPHY	33
APPENDIX	35

LIST OF TABLES

Table	Page
1. Data from First Questionnaire	10
2. Number of Computers by Category	11
3. Ownership Status of Computers	12
4. Number of Computers Used by Each School	12
5. Organizations or Companies Leasing Computers or Renting Time to the Schools	12
6. Number of Schools Using a Computer by Means of Timesharing	13
7. Modes of Access to the Computer in the Schools	13
8. Approximate Number of Interactive Terminals in Each School	13
9. Approximate Number of Student Jobs Run per Month in Each School ...	13
10. Approximate Number of Faculty Jobs Run per School Year in Each School	13
11. Number of Schools Using the Following Programming Languages	14
12. Programming Languages Having Greatest Use	14
13. Programming Languages Having Second Greatest Use	14
14. Computer Applications by Academic Departments	15
15. Factor(s) Influencing the Decision to Use a Computer for Instructional Purposes	16
16. Evaluations of the Traditional Instructional Patterns	16
17. Plans for the Next Five Years	17
18. Training of Teachers Using the Computer for Instructional Purposes	18
a. Pre-service Training	18
b. In-service Training	18
c. Organizations and companies providing pre-service or in-service training	18

9.

CHAPTER I

INTRODUCTION

STATEMENT OF THE PROBLEM

There is little or no information available concerning the instructional use of computers in the New Jersey secondary public schools. Information about this topic would be helpful for evaluating the present college curriculum in education, especially in mathematics education.

STATEMENT OF THE PURPOSE OF THE STUDY

The schools that use or plan to use the computer for instructional purposes will be identified through initial questionnaires. Specific computer applications to instructional uses will be examined through an additional questionnaire and visits to schools. The results of the questionnaires and visits will be used to make some recommendations concerning the professional education of secondary school mathematics teachers.

REVIEW OF THE SELECTED RELATED LITERATURE

Two related surveys on a national level have been invaluable in the development of this paper. There are three other surveys, discussed in this section, which are of less value to this paper even though one of them is a survey concerning the use of computers in the public school districts of New Jersey. Most areas concerning computers in education, about which there is literature available, are discussed in the second section. The literature in these areas, for the most part, is not directly related to this paper. This writer's intention is to present the reader with a general overview of computers in education by discussing a few sources in each area.

Primary Sources: Related Surveys

The Computer in Secondary Schools is a survey fairly similar to the one conducted for this study.¹ This book describes a nationwide survey concerning the use of computers

¹Charles A. Darby, Jr., Arthur L. Korotkin, and Tania Romashko, The Computer in Secondary Schools: A Survey of Its Instructional and Administrative Usage (New York: Praeger Publishers, 1972).

in secondary schools. It was sponsored by the National Science Foundation and was published in 1972. Administrative use and costs are questioned in more detail in this study than in mine. However, my study will obtain more information about teacher training. My survey pursues computer applications in a fashion suggested by Darby et al.

The American Institutes for Research undertook in 1974 a nationwide study, Computer Activities in Secondary Education, which appears to be a continuation of the Darby study.¹ This study, Computer Activities in Secondary Education, was also sponsored by the National Science Foundation. It reports on schools in several school districts of various states. These schools were chosen because the computer is used in an innovative fashion in their instructional programs. This study also shows the percent of administrative and instructional use throughout the country, but it has little information on teacher training. Quite interesting is the comparison with the results of the Darby study. For instance, there is an increase of computer use in the last five years despite rising costs and tight budgets. Also, each year more schools are accessing computers.

The next study, Survey of New Jersey Public School Districts Using Computers and Data Entry Equipment, contains the results of a 1975 survey of the 589 school districts in New Jersey.² This survey was conducted by the New Jersey State Department of Education. The tables and questionnaires show that the main objective of this study was to gather information on the kinds of equipment (computers, terminals etc.) used in the schools, the type of records processed by computer, agencies providing services and maintenance, and computer-related costs. However, it contains very little information about instructional com-

¹William J. Bolcoslei and Arthur L. Korotkin, Computer Activities in Secondary Education. Final Report (Washington, D.C.: American Institutes for Research in the Behavioral Sciences, 1975) (ED 112 935); Darby et al., The Computer in Secondary Schools.

²Irvin A. Gaydos, Survey of New Jersey Public School Districts Using Computers and Data Entry Equipment (Trenton: New Jersey State Department of Education, 1976) (ED 143 331).

puter applications and no information concerning the training of teachers who use the computer for instructional purposes.

The Use of Computers for Instructional Purposes contains information about computer-assisted instruction (CAI) programs that are already in operation in Illinois.¹ It was obtained by short questionnaires that were sent to forty persons in various school districts in Illinois. Most of the information concerned enrollment, type of computer, personnel support for computer operation, common CAI applications and CAI costs. Conclusions were that the most common uses of CAI were in the mathematics classes unrelated to programming and in the data-processing classes. It was also mentioned that many schools, of those responding, used the computer for teaching programming, data-processing and science.

Holt's report shows the results of a brief survey concerning current and potential uses of minicomputers in small educational institutions.² It presents very little information about the survey and it does not state clearly what is meant by small educational institutions. However, there is a lot of information concerning the minicomputer's administrative and instructional usage. Such topics as hardware, software, programming, costs and capabilities of minicomputers are discussed. In other words, this report has valuable information for anyone who is considering the purchase of a minicomputer for an educational institution.

Selected Secondary Sources

Many comparative studies have been conducted, such as the ones done by Perry, Ronan and Earle.³ The experiments of most comparative studies can be described in the

¹John Berryman, Richard Doring, and Daniel O'Rourke, The Use of Computers for Instructional Purposes -- A Preliminary Survey of Selected Secondary Schools in Illinois (Illinois: n.p., 1976) (ED 138 281).

²Richard C. Holt, Role of the Minicomputer in Small Educational Institutions (Toronto, Canada: n.p., 1974) (ED 100376).

³Robert P. Perry, LRC Computer Network (Washington, D.C.; n.p., 1973) (ED 084 822); Franklin Delano Ronan, "A Study of the Effectiveness of a Computer When Used as a Teaching and Learning Tool in High School Mathematics" (Thesis submitted to the School of Education of Michigan University, 1971); Harold Fred Earle, "Student Attitudes toward Geometry" (Ph.D. Dissertation, University of Maryland, 1972).

following general format.

There are two groups, group A and group B, each containing the same number of students. Usually pre-tests are given and show no significant differences between the groups. Group A is taught a certain subject by traditional methods, while group B is taught the same subject with the aid of a computer. This aid can be CAI, programming, or any other computer application. After a fixed period of time, both groups are post-tested and, in general, group B scores much higher than group A.

This writer suspects, after reading many such studies, that almost all of them were subject to the Hawthorn, or novelty, effect. Perry and Ronan's studies fit the above-mentioned format quite well. Earle's study differs in that it is concerned with attitudes rather than performance. His findings were quite interesting since they showed that there were no significant differences in attitudes toward geometry between traditionally taught students and students taught by CAI methods.

Several studies describe programs that are in operation and in which a computer is used for instructional purposes. After the description of the program, one is told how successful it is often without discussing how this conclusion was reached. One issue of Computer Decisions described a program of five elementary schools in Los Nietos School District, Southeastern Los Angeles County.¹ This district had installed an IBM System 370 Model 115, which provides each student with work tailored to his or her own ability. It was also mentioned that four-fifths of the population in this area is of Hispanic descent. The conclusions were that the attitudes, attendance and achievement rates of the students had improved considerably.

However, Levien treats the relative effectiveness of computer instruction in great detail.² He discussed quantity – how much is taught; quality – how well it is learned and how much the students retain; and rate – how fast they are learning. Also, suggestions on

¹"Computer-aided Teaching Narrows Learning Gap", Computer Decisions, June 1976, p.37.

²Roger E. Levien, The Emerging Technology: Instructional Uses of the Computer in Higher Education (New York: McGraw-Hill Book Company, 1972).

how to measure these characteristics of instruction are provided. Quite interesting is his thorough explanation of how one can compare costs of CAI to that of traditional instruction.

There are many sources that provide information on computers and their usage. Dyer's book is informative to persons who know hardly anything about computers and want to learn about computers on their own.¹ Hicks' and Hunka's book is for persons who are a little more familiar with CAI.² It includes topics such as writing lessons, planning in CAI, educational objectives in CAI and the teacher's role in CAI. More information can be obtained from articles such as Dwyer's.³ His article discusses topics such as auto-instructional laboratories, CAI curriculum development and computer based laboratories, which are all tied in with high school mathematics.

Some sources give quite specific information, such as Computers in the Classroom.⁴ This manual supplies the reader with demonstration programs and possible assignments for students. The text can be used page by page or as a well-indexed reference book. The major topics follow what is used in the Modern Algebra series by Dolciani, Berman and Wooton. Another book that fits in this category is the Computer Resource Book.⁵ It uses the BASIC language to show a collection of interesting things that can be done in algebra courses for first and second year algebra students.

¹Charles A. Dyer, Preparing for Computer Assisted Instruction (Englewood Cliffs, New Jersey: Educational Technology Publications, 1972).

²B.L.Hicks and Hunka, The Teacher and the Computer (Philadelphia: W.B. Saunders Company, 1972).

³Thomas A. Dwyer, "Soloworks: Computer-Based Laboratories for High School Mathematics", School Science and Mathematics 1 (January 1975): 93-99.

⁴Walter Noethe, Computers in the Classroom: Teacher's Resource Manual for Algebra (Maynard, Mass.: Digital Equipment Corp., 1971) (ED 052 605).

⁵T.A. Dwyer and M. Critchfield, Computer Resource Book - Algebra (Boston: Houghton Mifflin Company, 1975).

There are also many sources that give information concerning programming such as Elements of Computer Programming: FORTRAN and BASIC, An Introduction to Computer Programming Using the BASIC Language.¹

Administration and faculty are often faced with some of the following questions: What computer or computer system are we going to get? Who manufactures it? What computer software, programs or languages should be used for instruction? How many hours a day is the computer available? What kind of terminals are used and how many? Some of the answers can be found in "Choosing the Right Computer" and Briechele's article.²

Certain sources give a description of a program in a specific geographical area in which the schools use a computer for instructional purposes. A nice example is an article in The Mathematics Teacher.³ It describes a program of the Manitoba Department of Education (Canada) which has computer services throughout the province. Some of these services are provision of equipment, in-service courses for teachers and packages for administrative use. Available languages and costs are also discussed in this article.

Many other sources can be found in Computers in Education: A Bibliography, which lists 78 references and in Bibliography: Computers in the Mathematics and Science Classroom, which lists various sources for use by the teacher in and out of the classroom.⁴

¹Ellen Marnier and Donald Hartford, Elements of Computer Programming: FORTRAN (Albany, New York: Delmar Publishers, 1973); William F. Sharpe, BASIC, An Introduction to Computer Programming Using the BASIC Language (New York: The Free Press, 1967).

²William C. House, "Choosing the Right Computer", Journal of Educational Data Processing 3 (1976): 13-20; Robert L. Briechele, "Administrative Consideration as Related to the Implementation of CAI", Phi Delta Kappa. Computer Assisted Instruction: 19-45.

³D.A. McCaig and L.C. Jansson, "A School Computer Network", The Mathematics Teacher 71 (November 1978): 694-697.

⁴Peter J. Dirr, Computers in Education: A Bibliography (Buffalo, New York: n.p., 1978) (ED 105 677); Fremont Union High School District, Bibliography: Computers in the Mathematics and Science Classroom (Sunnyvale, California: n.p., 1975) (ED 107 296).

There seems to be very little information available on the pre- and in-service training of teachers who use the computer for instructional purposes. "Learning Teaching Mathematics" describes a college course in which students both learn mathematics and learn how to teach mathematics by programming a computer, but offers hardly any comparison with traditional teaching methods.¹ Hansen feels that teacher training in instructional use of computers is necessary.² Although his recommendations are non-specific as to content and duration of teacher training, it is his opinion that the rate of development of educational computer use appears to be primarily dependent upon the kind and extent of teacher and personnel training. But there is so little information available regarding the expenses of such programs that most cost estimates for training programs would be no better than guesses.

Tables, statistics and many more research related topics are discussed in Kerlinger's book.³ His point of view on survey research is quite negative, but he mentions that mail questionnaires are in popular use in education. He feels they have serious drawbacks unless there are also some other techniques used. His comments concerning the return rate of questionnaires are used in my survey.

¹B. du Bonlay, "Learning Teaching Mathematics", Mathematics Teaching 78 (March 1977): 52-57.

²Duncan N. Hansen, The Role of Computers in Education During the 70's (Washington, D.C.: Educational Resources Information Center, 1970).

³Fred N. Kerlinger, Foundations of Behavioral Research (New York: Holt, Rinehart and Winston Inc., 1966).

CHAPTER II

PROCEDURES OF THE STUDY

A list of all New Jersey public secondary schools was obtained from the New Jersey Department of Education. On April 6, 1978, a letter, definitions and a questionnaire were sent to each public secondary school in New Jersey. The principals of the schools that did not respond were contacted by telephone between May 5 and May 8.

The personnel of those schools that use a computer for instructional purposes received a second questionnaire, definitions and a letter, which were sent out on May 16.

Sixteen of the schools that returned the second questionnaire were randomly chosen for visits and interviews.¹ There were two schools that did not wish to be visited. Two other schools were selected instead. "Questions for Interviews" provided an outline of questions, but additional questions were asked depending upon the specific situation in each school.²

The responses to the questionnaires are tabulated and briefly commented upon in Chapter III. The results from visits and interviews are discussed in detail in Chapter III and IV. The total data is summarized and recommendations for secondary schools and institutions of higher learning are presented in Chapter IV.

¹Rand Corporation, A Million Random Digits with 100,000 Normal Deviates (Glencoe, Ill.: Free Press, publishers, 1955).

²The Appendix contains the letters, definitions, questionnaires and "Questions for Interviews" which are mentioned in the outline above.

CHAPTER III

RESULTS OF THE STUDY

PRESENTATION OF DATA

The names and addresses of all public secondary schools of New Jersey, 408 in number, were obtained from the New Jersey Department of Education's Directory of Approved New Jersey Secondary Schools, 1975-76.

A questionnaire was sent to each principal of these 408 schools.¹ There were 291 completed questionnaires returned by mail. Information was obtained by telephone calls to the remaining 117 that did not return their questionnaires. However, one school did not want to give any information over the telephone.

The total number of schools that have or use a computer is 290. Of these schools, 242 use a computer for instructional purposes, including 51 contacted by telephone. Nine of the remaining 48 schools intend to use a computer for instructional purposes in the next five years, 23 do not intend to use it for instructional purposes in the next five years, and 16 are undecided.

The total number of schools that do not have or use a computer at all is 117. Of these schools, 28 intend to have or use a computer in the next five years, 41 do not intend to have or use a computer in the next five years, and 48 are undecided. Of those 28 schools that intend to have or use a computer in the next five years, there are 18 that intend to use it for instructional purposes, two that do not intend to use it for instructional purposes and eight are undecided.

A breakdown in number and percentage of the complete data from the first questionnaire can be found in Table 1.

¹The first questionnaire was accompanied by a letter and definitions. See pages 37, 35 and 36 respectively in the Appendix.

TABLE 1
Data from First Questionnaire

	Number	Percent
1. Schools that have or use a computer.		
1a. Total number of schools that presently use a computer for instructional purposes.	242	59.3
1b. Schools that use a computer but do not use it presently for instructional purposes.		
1b1. Number of schools that plan to use it for instructional purposes in the next five years.	9	2.21
1b2. Number of schools that do not plan to use it for instructional purposes in the next five years.	23	5.64
1b3. Number of schools that are undecided as to whether to use a computer for instructional purposes in the next five years.	16	3.92
Total (1b.)	48	11.8
Subtotal (1.)	290	71.1
2. Schools that do not have or use a computer.		
2a. Schools that plan to have or use a computer in the next five years.		
2a1. Number of schools that plan to use it for instructional purposes.	18	4.41
2a2. Number of schools that do not plan to use it for instructional purposes.	2	.49
2a3. Number of schools that are undecided as to whether to use it for instructional purposes	8	2.
Subtotal (2a.)	28	6.9
2b. Number of schools that do not plan to have or use a computer in the next five years.	41	10.
2c. Number of schools that are undecided as to whether to have or use a computer in the next five years.	48	11.8
Total (2.)	117	28.7
Nonrespondents	1	.2
Total number of schools surveyed.	408	100

From the data of the first questionnaire we know that there are 242 schools that use a computer for instructional purposes. A second questionnaire was sent to each of these schools, addressed to the person who is in charge of the programs concerning the instructional use of the computer.¹ There was a return of 153 questionnaires or 63.2%. The data of these 153 questionnaires will be mainly presented in tables.

It was decided to create categories of computers since there are too many different kinds of computers in the schools. The following definitions are therefore necessary

SMALL COMPUTER: This is a machine with its own specific language such as the Olivetti Programma 101.

MEDIUM COMPUTER: This machine has at least one higher level language such as the IBM 1130 and Hewlett-Packard 2000.

LARGE COMPUTER: This machine has a lot more memory than a medium computer and has better dialects of the higher level languages such as WATFIV-S on the IBM 370/158 and IBM 370/168.

COMPUTER ASSISTED INSTRUCTION DEVICES: This is a special purpose machine such as the Classmate 88 for which the student does not write programs.

MISCELLANEOUS: This category includes the schools that gave partial or inconsistent information, or did not answer.

TABLE 2
Number of Computers by Category

Large	Medium	Small	CAI devices	Miscellaneous
15	94	1	8	57

¹The second questionnaire was accompanied by a letter and definitions. See pages 40, 41, 42, 38 and 39 respectively in the Appendix.

TABLE 3
Ownership Status of Computers

	Number of Schools
Own a computer ¹	75.5
Rent computer time	58
Lease a computer	21
Lease/purchase a computer	4
Donated computer time	3
Reciprocal agreement with the township	1
No response	2

TABLE 4
Number of Computers Used by Each School

	1 Computer	2 Computers	3 Computers	4 Computers
Number of Schools	136	9	5	1

TABLE 5
Organizations or Companies Leasing Computers or Renting Time to the Schools

Name of Organization or Company	Number of Schools	Name of Organization or Company	Number of Schools
Wayne Board of Education	23	NCR Century	2
Asbury Park Bd of Education	10	WINCL Corp.	2
Brookdale County College	6	Prime Computer, Inc.	1
Ocean County College		Cape Island Marina	1
Information Network	3	Rapidata	1
Philadelphia School District	2	City of Jersey City	1
NJECN	3	RCA Corp.	1
IBM Corporation	10	Instructional Computer Co-op	1
Digital Equipment Corp.	6	Does not apply	72
Hewlett-Packard Corp.	3	No response	3
Burroughs Corp.	2		

¹One computer is jointly owned with the school that did not respond.

TABLE 6
Number of Schools Using a Computer by Means of Timesharing

	Number of Schools
Number of schools that use a computer by means of timesharing.	79
Number of schools that do not use a computer by means of timesharing.	72
No response	2

TABLE 7
Modes of Access to the Computer in the Schools

	Number of Schools
Number of schools that use only batch processing.	26
Number of schools that use only interactive terminals.	85
Number of schools that use both interactive terminals and batch processing.	32
Small computers used like interactive terminals.	9
No response	1

TABLE 8
Approximate Number of Interactive Terminals in Each School

Number of Terminal(s)	1	2-5	6-14	28	33	Does not apply	No response
Number of Schools	33	61	20	1	1	34	3

TABLE 9
Approximate Number of Student Jobs Run per Month in Each School

Number of Job(s)	50 or less	51-150	151-250	251-1000	1001 or more	No response
Number of Schools	10	26	13	46	29	29

TABLE 10
Approximate Number of Faculty Jobs Run per School Year in Each School

Number of Job(s)	None	1-20	21-50	51-200	201 or more	No response
Number of Schools	21	43	20	15	18	36

TABLE 11
Number of Schools Using the Following Programming Languages

Language	Number of Schools	Language	Number of Schools
BASIC	126	NEAT/3	2
FORTRAN	62	DIBOL	1
COBOL	25	UNIX Language-C	1
RPG	23	SAMOS Language-C	1
ASSEMBLER Language	19	WDH	1
Machine Language	8	BASE 8	1
FOCAL	5	PLANIT - A CAI Language	1
APL	5	FORMS - A Screen Formatter	1
PL/I	4	RUNOFF - A Word Processor Lang	1
ALGOL	2	No response	2

TABLE 12
Programming Languages Having Greatest Use

Language	Number of Schools	Language	Number of Schools
BASIC	108	FOCAL	2
FORTRAN	22	ASSEMBLER Language	2
RPG	10	APL	1
COBOL	7	No response	1
Machine Language	4		

TABLE 13
Programming Languages Having Second Greatest Use

Language	Number of Schools	Language	Number of Schools
FORTRAN	30	PL/I	1
BASIC	9	BASE 8	1
RPG	8	NEAT/3	1
COBOL	6	ASSEMBLER Language	1
UNIX Language-C	2	Does not apply	91
APL	1	No response	2

TABLE 14
Computer Applications by Academic Departments

Academic Departments	CAI	CMI	Computational Aid to Problem Solving	Simulation	Data-Processing	Computer Science	Editing Word Processing	Operator Course
Mathematics	40	8	72	12	12	100		
Business	6	2	8	5	34	16	1	
Science	11	1	38	27	1			
Soc Science	1			13				
English	2							
Foreign Languages	3							
Electronics			1			1		
Comp Science						1		
Industrial Arts			1	1				
Aviation			1					
Accounting			6			1		
Economics	1			3				
Vocational Ed								1
Special Ed	1							
Does not list Academic Dpt	8	4	18	7	12	32		
Misc:	Guidance & Adm. Use		Enrichment		Computer Literacy		No Response	
	26		3		4		2	

TABLE 15
Factor(s) Influencing the Decision to Use a Computer for Instructional Purposes

Factors	Number of Schools
Increasing students' motivation	104
Increased computational power	40
Availability for administrative use	36
Increased information storage capability	24
Preparation for college and the current job market	20
Increasing computer awareness and literacy	18
To modernize the curriculum and trying to keep abreast of industrial needs.	16
Enrichment and expansion of the mathematics program	9
Reasons of economy	9
Compiling data from testing	7
Money or a computer was available	4
Student/parent request	1
Updating equipment	1
No response	9

TABLE 16
Evaluations of the Traditional Instructional Patterns

Evaluations	Number of Schools	Evaluations	Number of Schools
Needs assessment	55	No evaluation was conducted	12
Standardized testing of students	30	Students' interest and feedback	9
Observation of teacher effectiveness	26	Evaluation from the township	1
Community feedback	22	Teachers' suggestion	1
Does not understand the question	16	No response	43

TABLE 17
Plans for the Next Five Years

	Number of Schools
Schools that intend to buy or lease another computer with greater capacity in the next five years.	37
Schools that do not intend to buy or lease another computer with greater capacity in the next five years.	41
Schools that are undecided as to whether to buy or lease another computer with greater capacity in the next five years.	71
No response	4
Schools that intend to expand the use of the computer for instructional purposes in the next five years.	110
Schools that do not intend to expand the use of the computer for instructional purposes in the next five years.	6
Schools that are undecided as to whether to expand the use of the computer for instructional purposes in the next five years.	34
No response	3

TABLE 18
Training of Teachers Using the Computer for Instructional Purposes

a. Pre-service Training			
Bachelor's degree		Master's degree	
Mathematics	109	Mathematics	80
Computer Science	19	Computer Science	23
Business	23	Business	16
Science	4	Science	3
Vocational Education	2	Secondary Education	3
Industrial Education	1	Industrial Education	1
No response	21	No response	19

b. In-service Training	
Self studies (reading manuals and teaching oneself)	102
Other (see table 18c.)	87
Specialist in your school or school system	34
Expert from a college or university	19
No response	15

c. Organizations and companies providing pre-service and in-service training			
IBM Corp.	19	Interdata Corp.	1
Various graduate courses	19	Computer Institutes	1
NSF Institutes	12	U.S.Department of Commerce	1
Digital Corp.	7	Monroe Corp.	1
Worked previously in industry	5	Data General	1
Bell Laboratories	3	Honeywell	1
Hewlett-Packard Corp.	2	Wang Laboratories	1
U.S. Army	2	General Electric	1
Burroughs Corp.	2	AT & T	1
Wayne Board of Education	2	Synergistics Corp.	1
RCA Corp.	1	ASC - Computer Technology	1
Asbury School District	1	U.S. Air Force	1

The responses concerning possible additional training for teachers who use a computer for instructional purposes are too diverse for presentation in tabular form. These responses are therefore roughly categorized and presented in narrative form.

There were 24 responses suggesting methods courses especially designed for teachers who use the computer for CAI, simulation etc. and also teach programming. One of the major objectives of this course would show these teachers how to integrate the instructional uses of the computer in their courses. In two of these 24 responses it was mentioned that a summer course was preferred.

In-service training was preferred by 22 people. Two of these responded that teachers should be paid for participation in in-service training. Eight persons would like specialized training (equipment use) by the computer company from which the computer was purchased or leased.

There were only two persons who would like courses in CAI. However, programming courses in specific languages were in greater demand. Eleven persons would like courses in advanced BASIC, five would like courses in FORTRAN, two would like courses in Assembler Language and another two would like courses in COBOL. There was only one person who wanted a course in PL/I. Four responses just mentioned "courses in other languages."

Four people want courses in data-processing and one wants instruction in data base structures, file manipulating etc. Four persons would like to see more computer related courses (applications) in the college business departments.

Five responses indicated a preference for computer science courses as part of a mathematics program. One person wants a course in history of computers. Four persons want more computer related graduate courses but do not specify the nature of the courses.

Two people expressed their desire for more courses and workshops with other high-schools and colleges. Another two people want some good courses with a lot of hands-on experience, given by college or industry. One person would like to see more required courses

in programming. Another person would like more introductory courses. There was one request for a course concerning the society and the computer.

Three people stated that everybody, who is using or going to use a computer for instructional purposes, should have additional practical experience in industry. One person wants more time for teachers to work together. Three people want funding for teachers who participate in a program to learn more about computers and their use. One person wants more funding for training. Two people would like to see a seminar type interaction of users for keeping up to date with current developments. One person wants subscriptions to computer magazines for the students.

Two people urge "get more teachers to use the computer." One person wrote "anything." Four responses indicated that additional training was not necessary and there are 50 non-respondents.

Of the 153 schools that returned the second questionnaire, sixteen were chosen at random for visits and interviews.¹ Two of the schools which had programmable calculators and CAI devices did not wish to be visited, and two others were chosen as replacements. Thirteen of the interviews were recorded on tape. Three interviewees asked that the tape recorder not be used during the interviews with them. The information obtained from these visits will now be summarized in narrative form.

A range of different answers was given to the first question which concerned how each school got its initial information about computers and their use for instructional and administrative purposes. Five interviewees indicated that information was obtained in substantial part by talking with representatives of different computer companies. Two of these five also mentioned that literature on the subject and advice from colleges had been of great help, and one

¹Rand Corporation, A Million Random Digits with 100,000 Normal Deviates (Glencoe, Ill.: Free Press, publishers, 1955); See Appendix for "Questions for Interviews", pages 43 and 44.

of them indicated that some board of education members had also been very helpful.

Two other interviewees told me that schools which already had a program in operation were consulted. Another two interviewees said the computer was already in the building, being used for other purposes. One school had hired a consulting firm. Another school got advice from Dr. Peterson of the Wayne Board of Education and managed to obtain the use of a terminal free of charge for half a year. Two interviewees said there was federal funding available, but declined to give further information. One interviewee said that students who went to college complained that they should have had a background in computer science, but he gave no further details concerning the means by which the program in his school was initiated. Two interviewees simply stated that they did not know how the programs in their schools got started.

The interviewees were questioned concerning who was responsible for a program involving the use of the computer for instructional purposes being initiated in their schools. Nine of the sixteen interviewees were the persons who had started these programs in their schools. Of these nine one was a business teacher, one was an industrial arts teacher, and the others were mathematics teachers, one of whom received assistance from the Business Supervisor. In five schools one or more of the teachers in the mathematics department had volunteered to start the program. In one school the principal, a mathematics teacher, had started the program with the help of the business department. In another school the idea of having such a program had been suggested by a teacher, and the program was strongly advocated by a member of the board of education.

Questions concerning computer assisted instruction (CAI) and computer managed instruction (CMI) were posed to the interviewees. Ten schools had neither CAI nor CMI. Three schools bought commercially prepared programs. One school had both commercially prepared programs and programs written by the person who was interviewed. Two schools had CAI programs written by the interviewees, who were in the mathematics departments of these schools. In one of these two schools, some CAI programs had been

written by the better students. The commercially prepared programs came from the Hewlett-Packard Corporation, Wayne Board of Education, and a company in California.

The interviewees were asked how they had evaluated their efficacy in using the computer for instructional purposes. Five schools did not evaluate their program at all. In one school each student was tested before and after being exposed to CAI. The reactions of students, as observed by teachers, was the only evaluation made in five schools. Five others mentioned the reaction of their students, but also considered the feedback from their graduates. One of these latter schools conducted a survey to find out how helpful their program had been to their graduates who had entered the job market or who had gone to college.

The interviewees were questioned concerning the availability to their students of "hands-on" experience. Nine schools had students write programs, key punch their cards and put their cards into the card reader and/or had students work on terminals that were interactive or that had paper tape. One of these nine schools will also offer a course in computer operation next year. Seven other schools offered the same type of "hands-on" experience; however, in these seven schools the students also changed tapes, disks, or cassettes and performed other operator tasks.

An overall view of students' reactions to the use of the computer for instructional purposes was sought during the interviews. Fourteen interviewees said, "They love it!" One of the fourteen interviewees mentioned also that the absentee rate in the classes using computers was very small compared to those in other mathematics classes. Two of these interviewees added that the computer is a fantastic motivational tool. Two others indicated that the students compete for use of terminals. The three remaining interviewees said that most students love the use of the computer, but some do not like it. The ones who dislike it become too frustrated when their programs do not work after repeated runs.

Questions by the writer also probed faculty attitude towards the use of the computer for instructional purposes. The attitude of the entire faculty including most of the members of the mathematics department, was described in terms like the following: "very little interest", "magic show", "most faculty members do not know what is going on"; "distrust, since the teachers don't know how the machine works", "mild acceptance to hostility". Members of the mathematics faculty in one school are very happy that the interviewee is doing all the computer-related teaching. In another school half of the mathematics department faculty uses the computer for instructional purposes; the other half does not. In one school almost all the teachers like the fact that the computer is used for record keeping, recording attendance, etc. Two interviewees said that they had no idea of what the faculty attitudes were toward the use of the computer for instructional purposes.

The interviewees were quizzed as to whether there were any negative aspects of using the computer for instructional purposes. According to six of the interviewees there were no negative aspects to this mode of instruction. Four others mentioned that occasionally students "get hooked" and spend so much of their time at the terminal or key punch machine that they neglect their other course work or even cut their classes. One teacher said that students "getting hooked" on programming or other computer-related studies is not a negative aspect in his view, but is a symptom that other teachers were not doing their jobs well. Three interviewees said that there were too many demands for the computer and equipment they had available, which causes a struggle between the administration and faculty. One interviewee complained about vandalism, students copying programs from each other, and students who only play games. Another interviewee said some students become frustrated because of improper placement and mentioned that it often gets too noisy with machines operating and students talking.

The possibility of expansion in the near future of programs involving the use of the computer for instructional purposes was explored in the interviews. Additional ter-

minals are expected in four schools. The administrative use of the computer is the only expansion foreseen in two other schools. More freshman students will be exposed to data processing in one school. Another school intends to make more use of the computer in its vocational data-processing course and expects to obtain more memory for its computer. Two schools will get Radio Shack computers, and one of them will institute a course in computer operation. One school expects more extensive use of the computer in the mathematics, science, and business departments. Another will soon have its own computer in-house and intends to start CAI programs in other departments as well as in the mathematics department. Most likely there will be more computer-related courses in four schools. One interviewee indicated there will be no expansion in the program at that school, and another interviewee did not know whether any expansion in the program at that school was being contemplated.

The interviewees were asked what changes they would make in their programs if unlimited funds were available to them. The nature of the responses will be outlined in general terms since this question received the longest responses. Most interviewees indicated they would add more terminals and/or teletypes. Several interviewees suggested that their schools acquire large, IBM 370's in-house, so instructional and administrative computer usage could be carried on independently. Micro- and/or mini-computers were preferred by some interviewees. A few interviewees had rather modest goals, desiring more courses in computer science with more languages being made available and with more classes meeting each day.

The interviewees were questioned concerning how the complete staff of each school was informed as to the possible applications of the computer in their respective teaching fields and what their reactions were to that information. In eight schools the staff was inadequately informed since there were too many staff members, the computer system was of limited capacity, and there was not enough space and time. Three inter-

viewees indicated that no steps were taken in their schools to make the faculty aware of the availability of the computer as an instructional tool, and another interviewee indicated the faculty was briefly informed in a faculty meeting. In two schools briefing was done on an informal basis - interviewee to some interested teachers. In one school the principal announced they were going to have a computer, which was followed by a one-week, in-service course for five people who had been selected by him. Another school had an in-service school program provided by the company that manufactured its computer.

When the interviewees were asked how the staff reacted to the information given to them, eleven answered "Not relevant"; three said, "Favorably"; one replied, "They tried to use it but we haven't enough memory to work simulation or CAI programs"; and another said, "The information was too hard to understand for laymen".

Recommendations for a better in-service program were solicited from the interviewees. In the opinion of two of the interviewees the school should use professional days for informing the teachers. Two others suggested a two-day in-service course with sample canned programs to get teachers interested. "If we had a larger system, then the entire staff should be informed," said two interviewees. "As long as this school can use the computer for only a few hours per day, there is no use for in-service training," said another interviewee. Another suggested an in-service course for all departments, showing applications in their fields, meeting twice a week after school for several weeks. One interviewee made a short statement saying, "More time, training, money, and credits for participation in the training." A principal said, "I told them that we are going to have a computer, like it or not." After that statement he explained to them the advantages of having a computer, said that success depends on the rough data presented to the computer, and indicated that he expected nothing but success and advantage in having a computer. He told the writer during the interview that he considers the program a success after a year of hard work and forcing people to make use of the computer. The remaining interviewees simply desired in-service courses from the computer companies involved.

The interviewees were presented with the question: "If you were hiring a new teacher, how desirable would it be for the applicant to have some computer science background?" Thirteen interviewees indicated it would be very desirable, especially if the applicant were a mathematics teacher. Seven of these thirteen said that it would be desirable for applicants teaching in other fields. The two remaining interviewees indicated that such background was unnecessary, one of them indicating he is available to any member of the teaching staff at his school who desires help.

Some additional information was obtained during the interviews. Most mathematics departments required students to have taken algebra and geometry courses before entering computer science courses. The business departments required students to be able to type. The two vocational schools preferred students having some mathematics background, but had no specific course pre-requisites. The few schools that used the computer for CAI had no course pre-requisites for their students.

Most schools had either two computer science courses per school year or four mini-courses per school year, and the classes were very small. Classes in these courses were held only once or twice a week. Traditional courses in which the computer is used as a teaching tool were meeting more frequently.

INTERPRETATION OF DATA

Kerlinger states in his book that the return rate of mail questionnaires is generally low.¹ He also does not seem to favor telephone surveys. However, he continues, that a mail questionnaire in conjunction with other techniques might be more successful. Kerlinger also states that the results of questionnaires are most useful if the percent of the returns is at least 80 to 90.

¹Fred N. Kerlinger, Foundations of Behavioral Research (New York: Holt, Rinehart and Winston, Inc., 1966), p. 397.

In this study the first questionnaire was sent to all 408 secondary public schools in New Jersey. This questionnaire had a maximum of three short questions that a respondent was expected to answer. Therefore, it was possible to telephone the 117 schools that did not return the questionnaire. As a result there was only one non-respondent, which means a return rate of 99.8%.

The second questionnaire was mailed to 242 schools that use a computer for instructional purposes. This questionnaire was considerably longer than the first one, which made it virtually impossible to telephone the schools that did not return the questionnaire. Kerlinger mentions that return of less than 40 or 50% is likely if only a mail questionnaire is used.¹ He continues that the researcher often has to be content with returns of 50 or 60%. Of the 242 questionnaires that were mailed, 153 or 63.2% were returned. This rate of return is probably as good as could have been realized, but low enough that caution should be exercised in interpreting the results.

The main results of the second questionnaire are now summarized. There was a large variety of computers used in the schools. Medium-size computers such as the Hewlett-Packard 2000 and the IBM 1130 were used most frequently. Most schools own their computers, but there are a considerable number that rent computer time. The vast majority of schools make use of only one computer.

There is a large variety of organizations or companies from which the schools lease a computer or rent computer time. Approximately half the schools using computers do so by time-sharing methods. There are more schools that use interactive terminals than batch processing. Most schools have two to five interactive terminals.

The vast majority of schools teach BASIC, which is also the programming language that is in greatest use. FORTRAN is the second-most commonly used language in the schools. CAI, CMI, computational aid to problem solving, and computer science courses are

¹Fred N. Kerlinger, Foundations of Behavioral Research (New York: Holt, Rinehart and Winston, Inc., 1966), p.397.

used mostly by the mathematics departments.

Increasing students' motivation seems to be the main reason for the decision to use a computer for instructional purposes. When questioned about what type of evaluation of traditional instructional pattern had been conducted the principal response was, "needs assessment." Most schools do not intend to buy or lease another computer with greater capacity in the next five years. However, the vast majority intend to expand the use of the computer for instructional purposes in the next five years.

Most of the pre-service training of the teachers who use the computer for instructional purposes was incorporated in their master's degree in mathematics. Most of the in-service training consisted of self-studies. The responses to possible additional training for these teachers were quite varied. The main common interest was in a methods course that would show how to integrate the instructional uses of the computer into the high school courses.

CHAPTER IV

DISCUSSION

RECOMMENDATIONS

There are many different makes of computers used in the New Jersey secondary public schools. There are also several networks renting computer time to many of these schools. For some reasons it might be preferable to have a statewide network, with a single computer, like that in the Province of Manitoba, Canada.¹ The Manitoba Department of Education offers many services, such as in-service courses for teachers, equipment maintenance and administration services. Some problems such as in-service courses not fulfilling the need of the teachers and trouble with equipment are eliminated, since all schools that use a computer are hooked up to the same system. However, several schools in New Jersey have a medium-size, in-house computer. Students in most of these schools change disks or cassettes and do many other tasks that an operator would normally do. Some of these schools even offer courses in computer operation. This could not be done if schools were hooked up with a statewide network. The writer feels that it is difficult to give any recommendations in this matter.

Since New Jersey has schools in which students perform operator tasks or where operator courses are taught, we are also confronted with a problem in teacher training. In most cases, a teacher with a few computer science or data-processing courses in his or her pre-service training has no idea how to operate a medium-size computer such as a Digital PDP8/E. The writer wonders how practical it would be to offer a course in computer operation to undergraduates considering the many different makes of machines in the high schools. It is suggested instead that thought be given to developing a course in basic computer electronics and one in computer system organization, which would also provide the student some acquaintance with peripheral equipment.

Another suggestion came from several teachers who answered the question in the second questionnaire concerning possible additional training. They would like to see a

¹Duncan A. McCaig and Lars C. Jansson, "A School Computer Network", The Mathematics Teacher 71 (November 1978): 694-697.

methods course especially designed for teachers who use any computer applications in their classroom. The writer believes that such a course would also be advantageous to undergraduates. These teachers would like to put CAI, programming, simulation, graphics, etc. in this course. However, their main interest was to learn how to integrate the instructional uses of the computer in courses such as trigonometry, calculus and general mathematics.

In summary it is recommended that the following courses should be available to mathematics education majors, on the undergraduate and graduate levels:

- a. computer science courses that teach students to program in several languages;
- b. a course in which the student is taught to write CAI programs and learns more about graphics;
- c. a course in basic computer electronics;
- d. a course in computer system organization which also provides some acquaintance with peripheral equipment; and
- e. a methods course that ties some of these previous courses together, but in which the main objective is to show the student how the computer can be a teaching tool in high school mathematics.

The writer also feels that non-mathematics teaching majors should be exposed to computers in some kind of an introductory computer course. However, she has no suggestion as to the content of such a course, because there is insufficient feedback from non-mathematics teachers.

IMPLICATIONS FOR FURTHER STUDY

If one wants to keep up with the developments in the secondary public schools of New Jersey, then the writer suggests a follow-up study in five years. During two interviews

it became apparant that the data on the second questionnaires of these two schools had already changed. A similar study in the elementary schools might also be quite interesting.

The researcher conducting this type of study should be prepared to find an attitude of distrust on the part of some of those being interviewed in person or by telephone. Some of the telephone calls made in connection with the first questionnaire and a few of the interviews brought this to light. Initial hostility, followed with "Are you going to publish this?" or "Who are you representing?", was quite a common reaction although everything had previously been explained. Even when people were friendly, there was often a feeling of fear and distrust present.

Some problems encountered with certain questions in this survey will now be described. Hopefully, this will help anyone repeating the survey to obtain better results. In the first questionnaires there were a few questions concerning the use of the computer in the future and acquiring use of a computer in the future.¹ People who did not have sufficient information or authority to provide definite answers to these questions apparently were often the people who did in fact answer them. This seems to be the case, because the checked off answers often were accompanied by remarks such as, "If we get the money" or "Depends on the school board's decision."

In the second questionnaire there were several problems with the first question which asked what make and model computer was used by each school.² Some schools gave only the make of the computer. Others gave the name of their terminal or did not answer the question. This expanded the miscellaneous category to 57. In the next few questions it became obvious that some teachers did not know what one or both of the terms time-sharing and interactive terminals meant.

¹See Appendix, page 37.

²See Appendix, page 40.

The question concerning computer applications and the academic departments that use them, must have been too long. In several cases computer applications were checked off, but academic departments which are users were not listed.

Computer science courses were in most schools the only addition to the curriculum. It also did not change any of the other courses offered in these schools. Therefore the question, "What evaluation of your traditional instructional pattern did you conduct?" became somewhat irrelevant. This might account for the 43 non-responses and the 16 "Does not understand the question."

There was a similar problem during the interviews concerning the question, "What criteria have you used for evaluating the efficacy of the use of the computer for instructional purposes?" Some of the interviewees of the five schools that did not evaluate at all, did not initially understand the question. The others said that the question was not relevant since their school had only computer science courses. Probably, these evaluation questions asked in the second questionnaire and in the interviews should have been directed exclusively to those using computer applications other than computer science courses and data-processing courses.

The writer urges anyone repeating this study in the future to consider changing those questions that created problems in this study. Additional definitions of terms such as timesharing and interactive terminals could also be helpful.

27

SELECTED BIBLIOGRAPHY

- Berryman, John.; Doring, Richard.; and O'Rourke, Daniel. The Use of Computers for Instructional Purposes -- A Preliminary Survey of Selected Secondary Schools in Illinois. Illinois: n.p., 1976 (ED 138 281).
- Balcoslci, William J., and Korotkin, Arthur L. Computer Activities in Secondary Education. Final Report. Washington, D.C.: American Institutes for Research in the Behavioral Sciences, 1975 (ED 112 935).
- Briechele, Robert L. "Administrative Consideration as Related to the Implementation of CAI". Phi Delta Kappa. Computer Assisted Instruction: 19-45.
- "Computer-aided Teaching Narrows Learning Gap". Computer Decisions, June 1976, p.37.
- Darby, Charles A., Jr.; Korotkin, Arthur L.; and Romashko, Tania. The Computer in Secondary Schools: A Survey of Its Instructional and Administrative Usage. New York: Praeger Publishers, 1972.
- Dirr, Peter J. Computers in Education: A Bibliography. Buffalo, N.Y.: n.p., 1978 (ED 105 677).
- du Bonlay, B. "Learning Teaching Mathematics". Mathematics Teaching 78 (March 1977): 52-57.
- Dwyer, T.A., and Critchfield, M. Computer Resource Book -- Algebra. Boston: Houghton Mifflin Company, 1975.
- Dwyer, Thomas A. "Soloworks: Computer-Based Laboratories for High School Mathematics". School Science and Mathematics 1 (January 1975): 93-99.
- Dyer, Charles A. Preparing for Computer Assisted Instruction. Englewood Cliffs, N.J.: Educational Technology Publications, 1972.
- Earle, Harold Fred. "Student Attitudes Towards Geometry". Ph.D. dissertation, University of Maryland, 1972.
- Fremont Union High School District. Bibliography: Computers in the Mathematics and Science Classroom. Sunnyvale, California: n.p., 1975 (ED 107 296).
- Gaydos, Irvin A. Survey of New Jersey Public School Districts Using Computer and Data Entry Equipment. Trenton: New Jersey State Department of Education, 1976 (ED 143 331).
- Hansen, Duncan N. The Role of Computers in Education During the 70's. Washington, D.C.: Educational Resources Information Center, 1970.
- Hicks, B.L., and Hunka. The Teacher and the Computer. Philadelphia: W.B. Saunders Company, 1972.
- Holt, Richard C. Role of the Minicomputer in Small Educational Institutions. Toronto, Canada: n.p., 1974 (ED 100 376).
- House, William C. "Choosing the Right Computer". Journal of Educational Data Processing 3 (1976): 13-20.

- Kerlinger, Fred N. Foundations of Behavioral Research. New York: Holt, Rinehart and Winston Inc., 1966.
- Levien, Roger E. The Emerging Technology: Instructional Uses of the Computer in Higher Education. New York: McGraw-Hill Book Company, 1972.
- McCaig, D.A., and Jansson, L.C. "A School Computer Network". The Mathematics Teacher 71 (November 1978): 694-697.
- Marner, Ellen., and Hartford, Donald. Elements of Computer Programming: FORTRAN. Albany, N.Y.: Delmar Publishers, 1973.
- Noethe, Walter. Computers in the Classroom: Teacher's Resource Manual for Algebra. Maynard, Mass.: Digital Equipment Corp., 1971 (ED 052 605).
- Perry, Robert P. LRC Computer Network. Washington, D.C.: n.p., 1973 (ED 084 822).
- Rand Corporation. A Million Random Digits with 100,000 Normal Deviates. Glencoe, Ill.: Free Press, publishers, 1955.
- Ronan, Franklin Delano. "A Study of the Effectiveness of a Computer When Used as a Teaching and Learning Tool in High School Mathematics". Thesis submitted to the School of Education of Michigan University, 1971.
- Sharpe, William F. BASIC. An Introduction to Computer Programming Using the BASIC Language. New York: The Free Press, 1967.

APPENDIX

TRENTON STATE COLLEGE

Department of Mathematical Sciences
Trenton State College
Trenton, New Jersey 08625

April 5, 1978

Dear Principal:

The use of computers in secondary education has been increasing during the last decade, but little information concerning their use in New Jersey is available. Such information can be of help to colleges and universities, as well as to high schools, in planning their curricula. We at Trenton State College are interested in obtaining such information so that better training in this field can be offered both to undergraduates and to secondary school teachers continuing their education.

Therefore, we are conducting a survey concerning the use of computers for instructional purposes in your school, among others. Accordingly, would you please take a few minutes from your busy schedule to answer the three questions enclosed. Please return the questionnaire to us in the enclosed self-addressed, stamped envelope. Thank you for your cooperation.

Sincerely yours,

David E. Boliver

Dr. David E. Boliver, Assistant Professor
Department of Mathematical Sciences
Trenton State College

J. E. A. Versteegh-Limberg

Joyce E. A. Versteegh-Limberg
Department of Mathematical Sciences
Trenton State College

DEFINITIONS

To aid you in answering the questionnaire, the following definitions are provided.

Computers of interest in the present survey are those general purpose computers operating under the control of a stored program. The term computer refers to the integral system which includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment. To be considered a computer, a machine must be capable of producing more than routine mathematical computation as the end product of its operation.¹ The programmable calculator and computer assisted instruction devices such as Texas Instruments' "DATA MAN" are included. However, electronic accounting machines are specifically excluded.

Instructional purposes are all those classroom activities that involve the use of a computer.

¹ Charles A. Darby, Jr., Arthur L. Korotkin, and Tania Romashko, The Computer in Secondary Schools: A Survey of Its Instructional and Administrative Usage (New York: Praeger Publishers, 1972), pp. 7-8.

QUESTIONNAIRE

DOES YOUR SCHOOL HAVE OR MAKE USE OF A COMPUTER, MINI-COMPUTER, PROGRAMMABLE CALCULATOR OR COMPUTER ASSISTED INSTRUCTION DEVICE WHICH IS AT YOUR SCHOOL OR AT SOME REMOTE LOCATION? PLEASE CHECK BOX FOR THE APPROPRIATE ANSWER.

YES ☐

DOES YOUR SCHOOL PRESENTLY USE THE COMPUTER FOR ANY INSTRUCTIONAL PURPOSES?

YES ☐ NO ☐

WILL YOU PLEASE PRINT THE NAME OF THE PERSON IN YOUR SCHOOL SYSTEM WHO IS MOST LIKELY TO BE FAMILIAR WITH THE USE OF THE COMPUTER FOR INSTRUCTIONAL PURPOSES.
(This person will be contacted to fill out an additional questionnaire)

DO YOU INTEND TO USE IT FOR ANY INSTRUCTIONAL PURPOSES IN THE NEXT FIVE YEARS?

YES ☐ NO ☐ UNDECIDED ☐

YES ☐ NO ☐ UNDECIDED ☐

DO YOU INTEND TO HAVE OR USE A COMPUTER IN THE NEXT FIVE YEARS?

YES ☐ NO ☐ UNDECIDED ☐

DO YOU INTEND TO USE IT FOR ANY INSTRUCTIONAL PURPOSES?

YES ☐ NO ☐ UNDECIDED ☐

Name:
School:
Address:
City:
State: Zip:
Telephone:

THANK YOU VERY MUCH FOR COMPLETING THIS QUESTIONNAIRE. PLEASE RETURN IT TO US AS SOON AS POSSIBLE.

TRENTON STATE COLLEGE

Department of Mathematical Sciences

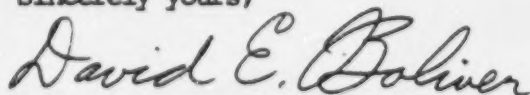
May 16, 1978

Dear Colleague:

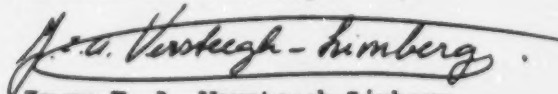
The principal of your school has given me your name as the person most familiar with your school's use of computers for instructional purposes. Probably you know that the use of computers in secondary education has been increasing during the last decade. However, little information concerning their use in New Jersey is available. Such information can be of great help to colleges and universities as well as to high schools in planning their curricula. We at Trenton State College are interested in obtaining such information so that better training in this field can be planned and offered both to undergraduates and to secondary school teachers continuing their education.

Therefore, we are conducting a survey concerning the use of computers for instructional purposes in your school, among others. Would you please help us by taking some time from your busy schedule to answer the enclosed questionnaire. Please return the questionnaire to us in the enclosed, self-addressed, stamped envelope. Thank you for your cooperation.

Sincerely yours,



Dr. David E. Boliver, Assistant Professor
Department of Mathematical Sciences
Trenton State College



Joyce E. A. Versteegh-Limberg
Department of Mathematical Sciences
Trenton State College

DEFINITIONS

To aid you in answering the questionnaire, the following definitions are provided:

Computers of interest in the present survey are those general purpose computers operating under the control of a stored program. The term "computer" refers to the integral system which includes the central processing unit, auxiliary storage, communication links, and all peripheral equipment. To be considered a computer, a machine must be capable of producing more than routine mathematical computation as the end product of its operation.¹ The programmable calculator and computer assisted instruction devices such as "Texas Instruments" "DATA MAN" are included. However, electronic accounting machines are specifically excluded.

Instructional purposes are all those classroom activities that involve the use of a computer, such as Computer Assisted Instruction, Computer Managed Instruction, computational aid to problem solving, simulation of real life situations, data-processing courses, and computer science courses.

¹ Charles A. Darby, Jr., Arthur L. Korotkin, and Tania Romashko, The Computer in Secondary Schools: A Survey of Its Instructional and Administrative Usage (New York: Praeger Publishers, 1972), pp. 7-8

QUESTIONNAIRE

Please refer to definitions on back of letter.

WHAT KIND OF COMPUTER (make and model) DOES YOUR SCHOOL USE? _____

DOES YOUR SCHOOL DISTRICT OWN OR LEASE THE COMPUTER, OR RENT COMPUTER TIME?
Please check box(es) for the appropriate answer(s).

OWN ☐

LEASE ☐

RENT COMPUTER TIME ☐

IF YOU LEASE THE COMPUTER OR RENT COMPUTER TIME, COULD YOU PLEASE WRITE DOWN THE NAME OF THE ORGANIZATION OR COMPANY FROM WHICH YOU LEASE OR RENT.

_____ DOES NOT APPLY ☐

DOES YOUR SCHOOL USE THE COMPUTER BY MEANS OF TIMESHARING? YES ☐ NO ☐

IN WHICH OF THE FOLLOWING WAYS DOES YOUR SCHOOL USE THE COMPUTER?

☐ BATCH PROCESSING

☐ INTERACTIVE TERMINALS

☐ OTHER (Please explain.) _____

IF YOU HAVE INTERACTIVE TERMINALS, HOW MANY DO YOU HAVE?

NUMBER OF TERMINALS _____

DOES NOT APPLY ☐

WHAT IS THE TOTAL NUMBER OF STUDENT JOBS RUN PER MONTH AT YOUR SCHOOL? If you don't know, could you please try to estimate it in the following way:

(# of programs in a school year times # of tries per program times # of students)
divided by # of months in a school year.

NUMBER OF JOBS _____ OR ESTIMATED NUMBER OF JOBS _____

WHAT IS THE TOTAL NUMBER OF FACULTY JOBS RUN PER SCHOOL YEAR? If you don't know, could you please make a similar estimate as in the question above.

NUMBER OF JOBS _____ OR ESTIMATED NUMBER OF JOBS _____

CHECK OFF THE PROGRAMMING LANGUAGE(S) USED IN YOUR SCHOOL.

☐ BASIC

☐ FORTRAN

☐ APL

☐ PL/I

☐ COBOL

☐ ALGOL

☐ COURSEWRITER

☐ OTHER (Please list.) _____

☐ MACHINE LANGUAGE

☐ ASSEMBLER LANGUAGE

☐ OTHER (Please list.) _____

Please look at questions on other side of this page.

WHICH LANGUAGE DO YOU USE MOST? _____

WHICH LANGUAGE HAS SECOND GREATEST USE? _____

☐ DOES NOT APPLY

PLEASE CHECK THOSE COMPUTER APPLICATIONS THAT ARE USED IN YOUR SCHOOL AND PRINT IN THE BLANK THE ACADEMIC DEPARTMENTS WHICH ARE USERS.

- ☐ COMPUTER ASSISTED INSTRUCTION (including drill and practice, tutorial and dialogue modes) _____
- ☐ COMPUTER MANAGED INSTRUCTION (including monitoring the students' learning needs and progress) _____
- ☐ COMPUTATIONAL AID TO PROBLEM SOLVING (in such subjects as science, mathematics, accounting, economics) _____
- ☐ SIMULATION OF REAL LIFE SITUATIONS (for example: cell division) _____
- ☐ DATA-PROCESSING COURSE(S) _____
- ☐ COMPUTER SCIENCE COURSE(S) (teaching students to write programs in one or more programming languages) _____
- ☐ OTHER (please explain) _____

WHICH OF THE FOLLOWING FACTORS INFLUENCED YOUR DECISION TO USE A COMPUTER FOR INSTRUCTIONAL PURPOSES? Check box(es) for the appropriate answer(s).

- ☐ REASONS OF ECONOMY
- ☐ COMPILING DATA FROM TESTING
- ☐ INCREASED COMPUTATIONAL POWER
- ☐ INCREASED INFORMATION STORAGE CAPABILITY
- ☐ INCREASING STUDENTS' MOTIVATION
- ☐ AVAILABILITY FOR ADMINISTRATIVE USE
- ☐ OTHER (Please list.) _____

WHAT EVALUATION OF YOUR TRADITIONAL INSTRUCTIONAL PATTERN DID YOU CONDUCT?

- ☐ STANDARDIZED TESTING OF STUDENTS
- ☐ NEEDS ASSESSMENT
- ☐ OBSERVATION OF TEACHER EFFECTIVENESS
- ☐ COMMUNITY FEEDBACK
- ☐ OTHER (Please list.) _____

DO YOU INTEND TO BUY OR LEASE ANOTHER COMPUTER WITH GREATER CAPACITY IN THE NEXT FIVE YEARS? YES ☐ NO ☐ UNDECIDED ☐

DO YOU INTEND TO EXPAND THE USE OF THE COMPUTER FOR INSTRUCTIONAL PURPOSES IN THE NEXT FIVE YEARS? YES ☐ NO ☐ UNDECIDED ☐

HOW WERE TEACHERS WHO USE THE COMPUTER FOR INSTRUCTIONAL PURPOSES TRAINED?
Check box(es) for the appropriate answer(s).

PRE-SERVICE TRAINING

BACHELOR'S DEGREE

- ☐ MATHEMATICS
☐ COMPUTER SCIENCE
☐ BUSINESS
☐ OTHER (Please list)

MASTER'S DEGREE

- ☐ MATHEMATICS
☐ COMPUTER SCIENCE
☐ BUSINESS
☐ OTHER (Please list)

IN-SERVICE TRAINING

- ☐ SPECIALIST IN YOUR SCHOOL OR SCHOOL SYSTEM
☐ EXPERT FROM A COLLEGE OR UNIVERSITY
☐ SELF-STUDIES (reading manuals and teaching oneself)
☐ ORGANIZATION OR COMPANY
Please list its name:

- ☐ OTHER (Please list.)

WHAT ADDITIONAL TRAINING FOR THESE TEACHERS WOULD BE USEFUL?

FIFTEEN SCHOOLS RESPONDING TO THIS QUESTIONNAIRE WILL BE RANDOMLY CHOSEN FOR VISITS AND INTERVIEWS. IN CASE YOUR SCHOOL IS CHOSEN, WHAT IS THE LAST DAY OF YOUR SCHOOL YEAR? _____

THANK YOU VERY MUCH FOR COMPLETING THIS QUESTIONNAIRE. PLEASE RETURN IT TO US AS SOON AS POSSIBLE.

QUESTIONS FOR INTERVIEWS

1. Use of the computer (hardware, software):

What were your sources of information about computers and their use for administrative and instructional purposes? (hardware, software, programming languages, cost, etc.)

How did you initiate the program involving the use of the computer for instructional purposes? (just one person, a specialist, a department, observed how other schools got started)

2. Computer applications:

Are the CAI and/or CMI programs which you use prepared by members of your own staff, by an expert retained by you, or do you buy commercially prepared programs?

If teachers write CAI and/or CMI programs, to which department(s) do they belong?

If you purchase commercially prepared programs, from what source do they come? Why did you choose this source?

3. Evaluation factors:

What criteria have you used for evaluating the efficacy of the use of the computer for instructional purposes?

To what extent do students obtain "hands-on" experience with the computer?

How do students react to the use of the computer for instructional purposes?

What is the faculty attitude towards this mode of instruction?

Have you observed any negative aspects of using the computer for instructional purposes?

4. Future:

In what direction do you foresee your program expanding in the near future?

What change(s) would you like to make if you had unlimited funds available?

5. Teacher training information;

How was your total staff informed of possible computer applications in their field?

How did they react to this information?

What recommendations do you suggest for changing the in-service orientation of staff, if change is needed?

If you were hiring a new teacher, how desirable would it be for the applicant to have some computer science background?